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The Business Perspective on Cloud Computing - A Literature Review of Research on Cloud Computing

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ABSTRACT

This literature review synthesized the existing research on cloud computing from a business perspective by investigating 60 sources and integrates their results in order to offer an overview about the existing body of knowledge. Using an established framework our results are structured according to the four dimensions following: cloud computing characteristics, adoption determinants, governance mechanisms, and business impact.

This work reveals a shifting focus from technological aspects to a broader understanding of cloud computing as a new IT delivery model. There is a growing consensus about its characteristics and design principles. Unfortunately, research on factors driving or inhibiting the adoption of cloud services, as well as research investigating its business impact empirically, is still limited. This may be attributed to cloud computing being a rather recent research topic. Research on structures, processes and employee qualification to govern cloud services is at an early stage as well.

Keywords

Cloud Computing, IT Services, Literature Review, Business Perspective, Business Value

INTRODUCTION

Triggered by the progressive adoption of the cloud computing paradigm in the IT service market the IT outsourcing industry enters into a state of flux. This finds its expression in the modification of the traditional provisioning model in IT outsourcing where IT resources are physically located at the client's or vendor's site. Cloud computing heralds the shift to an asset free IT provisioning model where highly scalable hardware, software and data resources are available over a network (Thomas and Redmond, 2009). Practitioners and academics alike discuss the question of whether cloud computing is part of the outsourcing evolution or if it brings about a revolution (Ingalsbe et al., 2011; Vouk, 2004). Indisputably, the emergence of the cloud computing paradigm will influence the way of doing business. According to Gartner the worldwide cloud services market will be worth $68.3 billion by the end of 2010, and that by 2014 the market will grow to be worth $148.8 billion (Pring et al., 2010). This can be attributed to clients' increasing demand for their vendors being able to provide IT services in a flexible, cost-effective and efficient manner under presence of customer-specific innovative abilities (Böhm et al., 2011).

Nevertheless, clients worry about the individual benefits and risks associated with this new IT deployment paradigm. According to Smith (2011) cloud computing is already showing some signs of disillusionment. He states that "over-reactions to high-profile outages, such as Amazon, have fed skeptical views. Yet, we continue to see an increased focus on the term and continued abuse of the term through "cloudwashing," increasing the hype" (Smith, 2011). In face of the hype being made and the majority of research being dedicated to the technical aspects, especially research regarding the business perspective of cloud computing is needed. This paper conducts a review of the literature to synthesize and integrate existing research and previous results to provide an understanding of the business aspects of cloud computing. Following Joachim (2011) who conducted an extensive literature review on the business perspective on SOA, this paper's review seeks to identify characteristics of cloud computing, determinants influencing cloud adoption, governance mechanisms for effectively implementing cloud services, and the actual business impact of cloud computing. The paper extends the previous works of

Böhm et al. (2010; 2009, 2011) and Leimeister et al. (2010) who worked on the characteristics of cloud computing and examined the cloud services industry from a value network perspective.

The remainder will first give an overview of the review process. Subsequently, the theoretical framework underlying this research endeavor is presented. It serves to structure the research results found during the review process. The following section presents the results of analyzing the identified literature. In the next section, we discuss the results and elaborate on demands for further research on the business perspective on cloud computing. The final section provides a short summary as well as a discussion of the review's limitations.

THEORETICAL FRAMEWORK

Recognizing the suggestions of Webster & Watson (2002) and Fettke (2006), a literature review framework is helpful to guide the literature analysis. To expose and structure research concerning the business perspective on cloud computing and discover areas where research is yet limited, we adapt frameworks used by Viering et al. (2009) as well as Joachim (2011) in related research fields. To structure the literature reviewed from a business perspective, we adapt the following four research questions:

- What are the ***characteristics*** of cloud computing?
  There is a plethora of characteristics mentioned in research together with cloud computing. This research question aims at analyzing and structuring them - thus answering the question of what cloud computing is. Accordingly, the research reviewed can mostly be classified as theory type "Analysis", as suggested by Gregor (2006).
- What are the determinants of cloud ***adoption*** in practice?
  This research question aims at factors influencing the adoption of cloud computing in practice. Articles are reviewed which provide predictions and have both, testable propositions and causal explanations. Accordingly the articles reviewed can mostly be classified as theory type "Explanation and Prediction" (Gregor, 2006).
- How are cloud services ***governed*** in business practice?
  This research question aims at research focusing explicit prescriptions on structures, processes and the alignment of business and IT, to implement and manage cloud services. Accordingly, the articles reviewed can mostly be classified as theory type "Design and Action" (Gregor, 2006).
- What is the organizational ***impact*** of cloud services?
  This research question aims at research focusing on the economic impact of implementing cloud services. Articles are reviewed which provide predictions and have both, testable propositions and causal explanations. Accordingly the articles reviewed can mostly be classified as theory type "Explanation and Prediction" (Gregor, 2006).

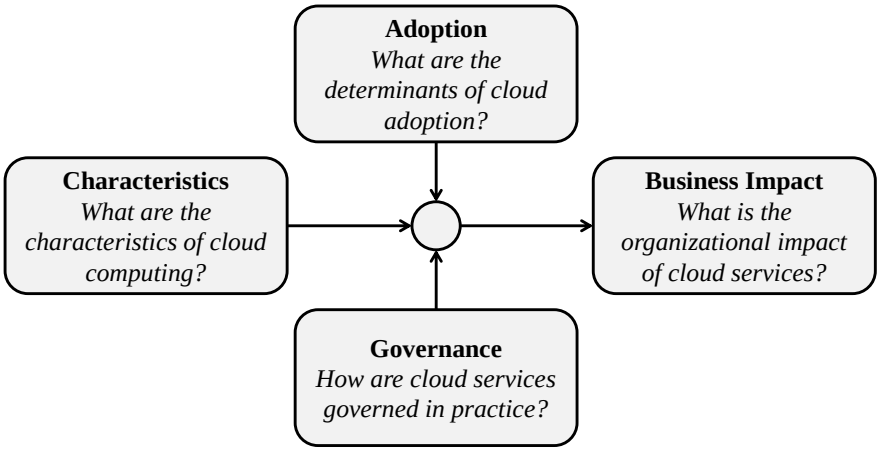

Figure 1: Framework of Analysis (adapted from Viering et al., 2009)

RESEARCH DESIGN

This literature review follows the framework by vom Brocke et al. (2009), which highlights the need for comprehensibly documenting the process of literature search in a review article. The framework describes five phases in order to structure a literature review.

Phase 1 (Review Scope): The definition of the review scope is summarized in Figure 1. It is our goal to integrate findings with respect to four areas (characteristics, adoption determinants, governance and business impact). As this review draws on the framework developed by Viering et al. (2009) and Joachim (2011), it is organized along a conceptual structure. According to the taxonomy of literature reviews, the coverage can be classified as representative as it is limited to samples of articles, which also stand for other articles, but does not explicitly consider the entirety of the literature.

Phase 2 (conceptualization): The step addresses the need of a broad conception of what is known about the topic (Torraco, 2005). This review draws on the framework developed by Joachim (2011) to address this need.

Phase 3 (sources): The literature search considered the sources presented in Table 1. These are selected based on the top 25 research journals according to the ranking developed by Lowry et al. (2004). In addition, the IBM Systems Journal which is listed as top global practitioner journal (Lowry et al., 2004) was included. Also, IS conferences are considered to cover more recent research in order to have a rounder picture. Table 1 lists the investigated journals and conferences, the respective fields which were searched and the coverage. Last, the hits for the keywords (cloud, utility computing, SaaS, Software as a Service, Software-as-a-Service, PaaS, Platform as a Service, Platform-as-a-Service, IaaS, Infrastructure as a Service, and Infrastructure-as-a-Service) as well as the number of articles used for the following analysis and synthesis are listed. The decision whether a retrieved article (hit) will be analyzed in detail in this literature review was made based on title and abstract. If the title sounded relevant to the focus of this review, the abstract was screened to make a final decision.

The two following phases of the framework for literature reviewing literature analysis and synthesis (4) as well as developing a research agenda (5) are described in detail in sections in the following sections, as these present the main contribution of the paper.

Journal / Conference	Search Fields	Coverage	Hits	Analyzed
MIS Quarterly	Title | Abstract | Keywords	1977-2011	0	0
Information Systems Research	Title | Abstract | Keywords	1990-2011	4	0
Journal of Management Information Systems	Title | Abstract | Keywords	1984-2011	6	1
Management Science	Title | Abstract | Keywords	1954-2011	1	1
Communications of the ACM	Title | Abstract | Keywords	1965-2011	37	10
Decision Sciences	Title | Abstract | Keywords	1970-2011	0	0
Information Systems Journal	Title | Abstract | Keywords	1998-2011	0	0
Organization Science	Title | Abstract | Keywords	1990-2011	2	0
Harvard Business Review	Title | Abstract | Keywords	1922-2011	10	1
INFORMS Journal of Computing	Title | Abstract | Keywords	1989-2011	1	0
Operations Research	Title | Abstract | Keywords	1952-2011	2	0
Journal of Computer Information Systems	Title | Abstract | Keywords	2000-2011	0	0
Decison Support Systems	All fields	1985-2011	32	1
Information and Organization	All fields	2001-2011	2	0
Information Systems	All fields	1975-2012	22	0
Information and Management	All fields	1977-2011	35	0
Journal of Strategic Information Systems	All fields	1991-2011	10	0
IEEE Transactions on Computers	Title | Abstract | Keywords	1972-2011	4	0

Table 1: Sources - Part 1

Journal / Conference	Search Fields	Coverage	Hits	Analyzed
IEEE Transactions on Services Computing	Title | Abstract | Keywords	2009-2011	15	0
IEEE Transactions on Software Engineering	Title | Abstract | Keywords	1985-2011	3	0
IEEE Computer	Title | Abstract | Keywords	1991-2011	21	1
ACM Transactions	Title | Abstract | Keywords	2001-2011	49	1
Journal of Information Systems	Title | Abstract | Keywords	1986-2011	1	0
Wirtschaftsinformatik	All fields	2006-2011	42	2
IBM Systems Journal	Title | Abstract | Keywords	1962-2008	12	2
IBM Journal of research and development	Title | Abstract | Keywords	1957-2011	11	2
European Journal of Information Systems (EJIS)	All fields	1997-2011	16	1
Journal of the Association for Information Systems (JAIS)	Title | Abstract | Keywords	2003-2011	1	0
International Conference on Information Systems (ICIS)	Title | Abstract | Keywords	1994-2011	18	5
Americas Conference on Information Systems (AMCIS)	Title | Abstract | Keywords	1997-2011	28	7
Hawaii International Conference on System Sciences (HICSS)	Title	2007-2011	11	5
Pacific Asia Conference on Information Systems (PACIS)	Title | Abstract | Keywords	1993-2011	4	2
European Conference on Information Systems (ECIS)	Title | Abstract | Keywords	1993-2011	19	5
Business and Information Systems Engineering (BISE)	Title | Abstract | Keywords	2009-2011	12	7
CCGRID	Title | Abstract | Keywords	2001-2010	84	6

Table 2: Sources - Part 2

Characteristics

This section presents the characteristics of cloud computing and cloud services found in research. Table 3 and Table 4 present the results of analyzing the articles questioning cloud computing characteristics. Overall 48 of the 60 identified articles discuss characteristics of cloud computing. The findings are grouped into five subcategories, namely: Design principles, service model, deployment models, market structure, and pricing models. The analysis revealed that literature on cloud computing converges with respect to a pivotal set of cloud characteristics. For example, it is common sense that the main pillars of cloud computing are the three service layer, Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) (Durkee, 2010; Kaisler and Money, 2011; Sarkar and Young, 2011). An exception to this rule is Armbrust et al. (2010) who propose a two-layered service model. The authors argue that it is quite impossible to draw a clear line between PaaS and IaaS which highlights the need of merging them into a utility computing layer. Service descriptions and SLAs are likewise often discussed design principles, whereby (Durkee, 2010) constitutes a contrast between service descriptions of current market offerings and descriptions demanded by enterprise customers. The differentiation potential of SaaS solutions is discussed by Katzmarzik (2011) as well as by in and Levina (2008). Regarding security principles we would like to stress the work of Owens (2010), which sheds light on inherent security challenges caused by design principles like virtualization and resource pooling.

Contrary to the commonly agreed upon characteristics, there are several ones addressed only by few authors, e.g. self-service as a design principle for cloud services (Hayes, 2008; Marston et al., 2011; Mell and Grance, 2010; Zainuddin and Gonzalez, 2011). Especially the definition provided by the National Institute of Standards and Technology [NIST] (Mell and Grance, 2010; NIST, 2011) gains popularity and seems to achieve agreement among practitioners and academia alike.

Potential deployment models like the hybrid and community cloud are rather unfamiliar. This review revealed only four publications which extend the basic notion of cloud computing as being public or private with mixed forms of service delivery (Armbrust et al., 2010; Janssen and Joha, 2011; Marston et al., 2011; Mell and Grance, 2010). Thus, there still exist distinctions regarding researchers' conception of the cloud concept. A promising approach to overcome those differences is suggested by Zainuddin and Gonzalez (2011) who define a maturity model for Software as a Service (SaaS) solutions, whereby for example self-service and scalability are characteristics only of mature services.

Factor	Description	Source / Discussed
Design Principles		
On Demand Self Service	"A consumer can unilaterally provision computing capabilities […] as needed automatically without requiring human interaction with each service's provider." (Mell and Grance, 2010)	(Mell and Grance, 2010), (Zainuddin and Gonzalez, 2011), (Marston et al., 2011), (Hayes, 2008)
Broad Network Access	"Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms." (Mell and Grance, 2010)	(Mell and Grance, 2010), (Marston et al., 2011), (Hayes, 2008), (Armbrust et al., 2010), (Kaisler and Money, 2011), (Leimeister et al., 2010), (Hay et al., 2011)
Resource Pooling	"The provider's computing resources are pooled to serve multiple consumers using a multitenant model, […] dynamically assigned and reassigned according to consumer demand." (Mell and Grance, 2010)	(Mell and Grance, 2010), (Zainuddin and Gonzalez, 2011), (Marston et al., 2011), (Hayes, 2008), (Armbrust et al., 2010), (Hay et al., 2011), (Owens, 2010), (Sonehara et al., 2011), (Vogels, 2009), (Weinhardt et al., 2009)
Scalability / Elasticity	"Capabilities can be rapidly and elastically provisioned […]. To the consumer, the capabilities […] often appear to be unlimited and can be purchased in any quantity at any time." (Mell and Grance, 2010)	(Mell and Grance, 2010), (Zainuddin and Gonzalez, 2011), (Marston et al., 2011), (Hayes, 2008), (Armbrust et al., 2010), (Kaisler and Money, 2011), (Leimeister et al., 2010), (Owens, 2010), (Vogels, 2009), (Brynjolfsson et al., 2010)
Measured Service	"Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service" (Mell and Grance, 2010)	(Mell and Grance, 2010), (Marston et al., 2011), (Kaisler and Money, 2011), (Leimeister et al., 2010), (Durkee, 2010), (Albaugh and Madduri, 2004)
Virtualization	Virtualization "[…] allows abstraction and isolation of lower level functionalities and underlying hardware." (Vouk, 2004)	(Marston et al., 2011), (Armbrust et al., 2010), (Leimeister et al., 2010), (Hay et al., 2011), (Sonehara et al., 2011), (Weinhardt et al., 2009), (Durkee, 2010), (Jin et al., 2009)
Service and Interface Description	"Paradoxically, despite the enormous concerns of potential cloud customers for lock-in, hold-up, and opportunistic repricing, almost no significant standardization efforts under way today are aimed at ensuring interoperability or portability among […] cloud vendors" (Clemons and Chen, 2011)	(Marston et al., 2011), (Armbrust et al., 2010), (Kaisler and Money, 2011), (Brynjolfsson et al., 2010), (Durkee, 2010), (Jansen, 2011), (Clemons and Chen, 2011), (Katzmarzik, 2011), (Janssen and Joha, 2011), (Koehler et al., 2010a), (Ortiz, 2011), (Brocke et al., 2011), (Tung, 2011), (Dastjerdi et al., 2010), (Clarke, 2010), (Mangler et al., 2010), (Breiter and Behrendt, 2009), (Buxmann et al., 2008), (Fuller and McLaren, 2010)
Limited customizability	"Customer-specific configuration can be made at the meta-data layer on top of the common code using interfaces provided by the SaaS vendor." (Xin and Levina, 2008)	(Zainuddin and Gonzalez, 2011), (Marston et al., 2011), (Kaisler and Money, 2011), (Katzmarzik, 2011), (Koehler et al., 2010a), (Brocke et al., 2011), (Breiter and Behrendt, 2009), (Buxmann et al., 2008), (Fuller and McLaren, 2010), (Xin and Levina, 2008), (Winkler et al., 2011)
Security and Privacy	"[…] it is clear that providing adequate administrative separation between virtual customer environments will be a significant security challenge with elasticity." (Owens, 2010)	(Hayes, 2008), (Armbrust et al., 2010), (Kaisler and Money, 2011), (Hay et al., 2011), (Owens, 2010), (Sonehara et al., 2011), (Vogels, 2009), (Brynjolfsson et al., 2010), (Durkee, 2010), (Jansen, 2011), (Clemons and Chen, 2011), (Breiter and Behrendt, 2009), (Anthes, 2010), (Kerschbaum, 2011)
Service Model		
SaaS	"The end customer is purchasing the use of a working application." (Durkee, 2010)	(Mell and Grance, 2010), (Armbrust et al., 2010), (Kaisler and Money, 2011), (Weinhardt et al., 2009), (Durkee, 2010), (Clemons and Chen, 2011), (Tung, 2011), (Sarkar and Young, 2011), (McAfee, 2011)
PaaS	"The capability […] to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages and tools supported by the provider." (Mell and Grance, 2010)	(Mell and Grance, 2010), (Kaisler and Money, 2011), (Durkee, 2010), (Weinhardt et al., 2009), (Clemons and Chen, 2011), (Tung, 2011), (Sarkar and Young, 2011), (McAfee, 2011)
IaaS	"The capability […] to provision processing, storage, networks, and other fundamental computing resources […]." (Mell and Grance, 2010)	(Mell and Grance, 2010), (Kaisler and Money, 2011), (Weinhardt et al., 2009), (Durkee, 2010), (Clemons and Chen, 2011), (Tung, 2011), (Sarkar and Young, 2011), (McAfee, 2011)
Deployment Model		
Public	"The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services." (Mell and Grance, 2010)	(Mell and Grance, 2010), (Marston et al., 2011), (Armbrust et al., 2010), (Kaisler and Money, 2011), (Janssen and Joha, 2011), (Breiter and Behrendt, 2009), (McAfee, 2011)
Private	"[…] internal data centers […], not made available to the general public, when they are large enough to benefit from the advantages of cloud computing" (Armbrust et al., 2010)	(Mell and Grance, 2010), (Marston et al., 2011), (Armbrust et al., 2010), (Kaisler and Money, 2011), (Janssen and Joha, 2011), (Breiter and Behrendt, 2009), (McAfee, 2011)
Hybrid	" […] a composition of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology" (Mell and Grance, 2010)	(Mell and Grance, 2010), (Marston et al., 2011), (Armbrust et al., 2010), (Janssen and Joha, 2011)
Community	"The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns." (Mell and Grance, 2010)	(Mell and Grance, 2010), (Marston et al., 2011), (Janssen and Joha, 2011)

Table 3: Characteristics - Part 1

Factor	Description	Source / Discussed
Market Structure		
Decentralized Market	"Decentralized market approaches […] establish a matching of supply and demand in a Peer-2-Peer manner and thus overcome the bottleneck found in a centralized market." (Vykoukal et al., 2009)	(Zainuddin and Gonzalez, 2011), (Marston et al., 2011), (Leimeister et al., 2010), (Brynjolfsson et al., 2010), (Durkee, 2010), (Clarke, 2010), (Buxmann et al., 2008), (Fuller and McLaren, 2010), (Vykoukal et al., 2009), (Cusumano, 2010), (Campbell-Kelly, 2009), (Lassila, 2006), (Beimborn et al., forthcoming), (Demirkan et al., 2010)
Provider	"Service providers, also labeled IT vendors, develop and operate services that offer value to the customer […]." (Böhm et al., 2011)	(Marston et al., 2011), (Leimeister et al., 2010), (Clarke, 2010), (Buxmann et al., 2008), (Campbell-Kelly, 2009), (Beimborn et al., forthcoming), (Demirkan et al., 2010), (Koehler et al., 2010b)
Consumer / Customer	"The customer buys services through various distribution channels, for example, directly from the service provider or through a platform provider." (Leimeister et al., 2010)	(Marston et al., 2011), (Leimeister et al., 2010), (Koehler et al., 2010a), (Clarke, 2010), (Buxmann et al., 2008), (Beimborn et al., forthcoming), (Demirkan et al., 2010), (Koehler et al., 2010b)
Integrator / Aggregator	Offers "[…] new services or solutions by combining pre-existing services or parts of services to form new services and offer them to customers." (Leimeister et al., 2010)	(Leimeister et al., 2010), (Buxmann et al., 2008), (Lassila, 2006), (Demirkan et al., 2010)
Pricing Model		
Pay per Use	"Much like a utility, cloud resource charges are based on the quantity used." (Durkee, 2010)	(Marston et al., 2011), (Armbrust et al., 2010), (Kaisler and Money, 2011), (Leimeister et al., 2010), (Weinhardt et al., 2009), (Koehler et al., 2010b), (Du et al., 2011), (Bubendorfer et al., 2006), (Sewook, 2011), (Png and Wang, 2010), (Lehmann and Buxmann, 2009)
Fixed fee	"Fixed fee tariffs are dominant on a SaaS layer." (Koehler et al., 2010b)	(Marston et al., 2011), (Weinhardt et al., 2009), (Koehler et al., 2010b), (Png and Wang, 2010), (Lehmann and Buxmann, 2009)

Table 4: Characteristics - Part 2

ADOPTION

Our search for publications dedicated to the question of why organizations adopt or rather reject integrating cloud services into their IT landscape revealed 10 papers. Only four papers empirically examined factors potentially influencing organizations' propensity to adopt (Benlian, 2009; Benlian et al., 2009; Sarkar and Young, 2011; Saya et al., 2010). In addition, two papers explore consumer preferences for cloud service attributes (Benlian, 2011; Koehler et al., 2010a). For example, Benlian (2011) examines how open-source and Software as a Service applications compare with proprietary on-premise software in the fulfillment of firms' evaluation criteria. Although it is not explicitly directed towards investigating adoption, it provides valuable insights into the differences between IS managers of small and medium-sized enterprises compared to those of large enterprises regarding the perceived relative performance of the different delivery models. The four remaining papers are conceptual in nature (Breiter and Behrendt, 2009; Janssen and Joha, 2011; Son and Lee, 2011; Xin and Levina, 2008). It is quite interesting that researchers predominantly focused on application services delivered through the cloud (Benlian, 2009; Benlian, 2011; Benlian et al., 2009; Janssen and Joha, 2011; Koehler et al., 2010a; Xin and Levina, 2008) (i.e., Software as a Service) and cloud computing in general (Breiter and Behrendt, 2009; Sarkar and Young, 2011; Saya et al., 2010; Son and Lee, 2011). Table 5 gives an overview of the adoption factors provided by the literature which were tested empirically. It shows that although the cloud computing paradigm has become quite omnipresent in IS literature, research is still lacking to provide a comprehensive view upon drivers and inhibitors of the organizational decision to adopt cloud services.

Factor	Description	Findings	Source
Technology			
Abandonment options	"[…] refers to the possibility of discontinuing it [an innovation] and redeploying remaining resources effectively." (Saya et al., 2010)	XaaS: supported	(Saya et al., 2010)
Asset specificity	Asset specificity is "[…] reflected in the degree that specific applications can be customized, integrated, and modularized prior to and in the outsourcing relationship." (Benlian et al., 2009)	SaaS: partly	(Benlian, 2009; Benlian et al., 2009)
Cost of capital	"Building a new data-center or renovating current facilities for the purpose was going to cost the university up to Aus $35 million and taken a minimum of two years." (Sarkar and Young, 2011)	PaaS: supported IaaS: supported	(Sarkar and Young, 2011)
Cost reduction	"Cost-differential was not a primary driver as the IT department would still need to be involved with content management, customization, and integration with internal applications." (Sarkar and Young, 2011)	SaaS: not supported	(Sarkar and Young, 2011)
Deferral options	"[…] refers to the possibility of delaying an investment in order to learn more about it before committing to the investment." (Saya et al., 2010)	XaaS: not supported	(Saya et al., 2010)
Growth options	"[…] refers to the opportunity to pursue potential follow-on investments beyond what was initially anticipated." (Saya et al., 2010)	XaaS: supported	(Saya et al., 2010)
Inimitability	Inimitability is the extent to which "[…] applications represent indispensable and non-substitutable factors in the core processes of companies enabling them to gain competitive advantages." (Benlian et al., 2009)	SaaS: partly	(Benlian et al., 2009)
IT flexibility	"[…] the "speed of delivery", not the cost differential, was the prime driver behind the university's consideration of cloud services." (Sarkar and Young, 2011)	XaaS: supported	(Sarkar and Young, 2011)
Security and privacy	"Security and privacy were still primary concerns, which meant legacy systems such as the ESS and SAMS applications were to remain housed internally." (Sarkar and Young, 2011)	XaaS: supported	(Sarkar and Young, 2011)
Strategic value	Extend to which applications automate strategic business processes and thus are "[…] likely to require extensive customization." (Xin and Levina, 2008)	SaaS: partly	(Benlian et al., 2009; Sarkar and Young, 2011)
Organization			
Access to external IT capabilities	"Deciding on whether to purchase applications and run them internally, or get the vendor to provide us the services of the applications, is a question of capability and resources." (Sarkar and Young, 2011)	SaaS: supported	(Sarkar and Young, 2011)
Change of roles / responsibilities	"[…] the IT department was undergoing a gradual transformation in its role and responsibilities within the university." (Sarkar and Young, 2011)	XaaS: supported	(Sarkar and Young, 2011)
Lock-in	"[…] once the vendor's got you, they can gradually start charging you to a point where it can offset cost-savings, but you are unable to revert back to your own in-house ICT infrastructure as it's no longer there." (Sarkar and Young, 2011)	XaaS: supported	(Sarkar and Young, 2011)
Organization size	"[…] smaller and medium-sized firms are generally more prone to adopt on-demand outsourcing options for obtaining fast access to valuable IT resources and capabilities." (Benlian et al., 2009)	SaaS: not supported	(Benlian et al., 2009)
Usage frequency	Usage frequency is "[…] the extent to which the application is used frequently by different internal and external users." (Benlian, 2009)	SaaS: not supported	(Benlian, 2009)
Environment			
Subjective norm	"[…] organizations may forgo rational calculations in favor of mimicking their successful peers." (Xin and Levina, 2008)	SaaS: supported	(Benlian et al., 2009)
Uncertainty	"Uncertainty describes the impact of bounded rationality on transaction risks" (Haried and Zahedi, 2004). When uncertainty is high, the sourcing arrangement is exposed to frequent, often radical changes over time.	SaaS: partly	(Benlian, 2009; Benlian et al., 2009)

Table 5: Adoption

GOVERNANCE

Retrieving publications regarding clients' governance of cloud services shows sparse results. There is only one paper which is explicitly dedicated to governance issues related to the implementation of cloud services into the IT landscape of organizations (Winkler et al., 2011). In the remaining papers governance issues are only mentioned in passing remarks (Janssen and Joha, 2011; Marston et al., 2011; Martens and Teuteberg, 2011; Ross and Westerman, 2004; Sarkar and Young, 2011). Interestingly, no paper could be found which develops or applies a governance framework tailored to the specific challenges users are confronted with when adopting cloud services. Nevertheless, it can be observed that researchers put an emphasis on structural aspects of IT governance, e.g. architectural standards or decision rights. Only one article could be found addressing the arising challenges toward employee qualifications (Janssen and Joha, 2011). This section's findings are summarized in Table 6.

Aspect	Description	Source
Structures		
Decision authorities	Organizational committees which are responsible for "[…] application changes, financials and architecture […]." (Winkler et al., 2011)	(Winkler et al., 2011)
Processes	"To plug-and-play the many services that utility computing may offer, firms may need to fashion many of their vendor relationships like transactions, that is, through fashioning […] standard processes for monitoring performance." (Ross and Westerman, 2004)	(Ross and Westerman, 2004)
Metrics	"The firm is able to manage large numbers of vendors because it has standardized the interface with its suppliers and standardized the metrics for assessing the relationship." (Ross and Westerman, 2004)	(Ross and Westerman, 2004)
Architecture	"Another critical factor is an architecture that specifies technical standards and defines the components of technology and business process." (Ross and Westerman, 2004)	(Ross and Westerman, 2004)
Privacy	"Cloud computing raises new privacy issues that require clear standards for custodians of this information who receive government requests for access to that information." (Marston et al., 2011)	(Marston et al., 2011)
Roles and responsibilities	"[…] the IT department was undergoing a gradual transformation in its role and responsibilities within the university […]" (Sarkar and Young, 2011)	(Janssen and Joha, 2011; Sarkar and Young, 2011)
Parity groups	"[…] it is necessary to involve the IT group in selecting and implementing SaaS solutions, as they have knowledge about issues like choosing architectural options such as single or multi-tenancy design, security and detection of Intruders." (Janssen and Joha, 2011)	(Janssen and Joha, 2011; Sarkar and Young, 2011)
Processes		
Compliance management	"[…] companies could face regulatory compliance risks, if they transfer and process sensitive data which are exposed to legal regulations." (Martens and Teuteberg, 2011)	(Martens and Teuteberg, 2011)
IS policy	"For large enterprises, it is also important to implement an organization-wide consistent IS policy across the different cloud computing services […]" (Marston et al., 2011)	(Marston et al., 2011; Sarkar and Young, 2011)
Employees		
Qualification	"[…] there is a shift from technical issues to expertise and knowledge in sourcing and developing management capabilities to control the relationships." (Janssen and Joha, 2011)	(Janssen and Joha, 2011)

Table 6: Governance

BUSINESS IMPACT

The term cloud computing is misused by many IT service providers for marketing purposes. As a consequence, organizations are wary about buying cloud services for it is ambiguous what benefits they can reap (Smith, 2011). Thus, research is needed which investigates the impact of cloud services adoption on organizations. In this literature review only empirical research is investigated. In total, only two publications could be identified which are geared towards investigating the impact of cloud computing adoption on organizations (Martens and Teuteberg, 2011; Son et al., 2011). The articles provide evidence for the positive impact of cloud computing adoption announcements on firm valuation. In addition, Winkler et al. (2011) do not investigate the business impact of cloud computing but the factors influencing the allocation of authorities between business and IT for SaaS applications within client organizations. Their findings from four case studies indicate that the adoption of cloud services may have a positive impact on the alignment between business and IT. Furthermore, Sarkar and Young (2011) examine motivators and concerns regarding cloud services in a longitudinal case study with a large Australian university. They found out that the main benefits of adopting Infrastructure as a Service were increased scalability, reduction of IT infrastructure complexity, increased agility and cost reduction. The findings of this review section are summarized in Table 7.

Aspect	Description	Findings	Source
IT benefits			
Scalability	"The external datacentre was a "smart" facility in terms of energy consumption, design, and layout, and could easily host more servers as per demand." (Sarkar and Young, 2011)	IaaS: supported	(Sarkar and Young, 2011)
Reduction of complexity	"[…] going with them [the cloud provider] reduces our responsibilities as part of our infrastructure is now being maintained by the vendor's technical support." (Sarkar and Young, 2011)	IaaS: supported	(Sarkar and Young, 2011)
IT agility	"Building a new data-center or renovating current facilities for the purpose was going to cost the university up to Aus $35 million and taken a minimum of two years." (Sarkar and Young, 2011)	IaaS: supported	(Sarkar and Young, 2011)
Business benefits			
Cost reduction	Moving to the cloud "[…] drastically reduced the need for in-house physical spaces allocated for the IT infrastructure, which could now be re-allocated to revenue generating areas of teaching and learning." (Sarkar and Young, 2011)	IaaS: supported	(Sarkar and Young, 2011)
Market value	"The results indicate that cloud computing adoption announcements are associated with positive increases in the market value of the firm." (Son et al., 2011)	XaaS: supported	(Martens and Teuteberg, 2011; Son et al., 2011)
Business/IT alignment	"And now [after implementing SaaS] business and the IT work together rather than it seems that one is holding over the other." (Winkler et al., 2011)	SaaS: partly	(Winkler et al., 2011)

Table 7: Business Impact

DISCUSSION

Characteristics of cloud computing are mostly defined based on constituent features of services on offer. Papers describing characteristics of cloud computing services taking a customer focus are rare. We would like to highlight a few exceptions such as (Koehler et al., 2010b), e.g. showing, customers mostly prefer a fixed fee over the pay-per-use model. Besides pricing, the authors introduce further characteristics of cloud services with customer focus such as "Provider Reputation" and "Consumer Support" in another article (Koehler et al., 2010a). Their research provides a good starting point to expand the yet limited foundation of cloud service characteristics relevant to customers. Further, the maturity approach designed by Zainuddin and Gonzales (2011) for SaaS could be very helpful to classify services from a customer perspective and thus assist customers when choosing a service.

The review of the literature revealed that to date only limited empirical research regarding the factors driving or inhibiting the organizational decision to adopt cloud services and the business impact of cloud services adoption exists. However, at least two promising research-in-progress papers could be identified which contribute to the adoption and diffusion stream of research. Xin and Levina (2008) propose a conceptual model to investigate the determinants influencing clients' decision to adopt the SaaS model. The authors announced testing the model in the future on a broad empirical basis. In contrast, Nuseibeh (2011) focuses on adoption determinants as well but develops a theoretical model to examine the broader concept of cloud computing. Nevertheless, further research on this subject is needed. A comprehensive study which identifies enablers and inhibitors for cloud adoption would help clients' and vendors' as well in developing practical guidelines for strengthening enablers and reducing inhibitors. Interestingly, current literature predominantly focuses on SaaS. Especially, rich and in-depth case studies would give us more credible answers to the questions: How do determinants of adoption differ between SaaS, PaaS, and IaaS? Are there any patterns of adoption? What does the implementation process look like?

Closely related to the question 'Why do organizations adopt cloud?' is the question 'What is the business impact of cloud adoption on organizations?'. Insights into the business value of cloud computing aids managers in analyzing the appropriateness of cloud services for their particular organization-specific setting in order to justify their adoption decision. Apart from mere cost related benefits some of the more interesting, yet understudied work, is looking at the rather intangible benefits for IT and business, e.g. IT/business alignment (Winkler et al., 2011). Beyond that researchers need to investigate how to successfully govern a cloud endeavor. Clients have to face various new challenges when moving to the cloud. Without effective cloud governance shadow IT will become an even greater issue, the risk of getting locked-in to a vendor will rise, and the uncontrolled adoption of different cloud services might lead to costly redundancies and incompatibilities. It is a surprise that none of the literature covered in this review provided an integrated framework for clients' cloud governance.

SUMMARY AND OUTLOOK

This literature review synthesized the existing research on cloud computing from a business perspective by investigating 60 sources and integrates their results in order to offer an overview about the existing body of knowledge as well as to reveal research gaps.

Research has moved on from a pure technical perspective to business aspects of cloud computing. However, research regarding the customer-perspective of cloud computing is still limited. It is worth to note that the discussion around cloud computing and the standardization efforts of the NIST seem to bear fruit. Most of the design principles and characteristics of cloud computing cited above can be referred to as common sense within the research community. Looking at the vast amount of new cloud services emerging every day, researchers might focus their work on the development of instruments (e.g. taxonomies and typologies) which serve cloud users to clear through the market of cloud services.

Empirical research on factors driving or inhibiting the adoption of cloud services, as well as research investigating its business impact, is limited. This may be attributed to the fact that cloud computing is a very recent research topic. Empirical research is time consuming and hopefully studies on these topics are due for publication. Research on structures, processes and employee qualification to govern cloud services from a customer's perspective is at a very early stage.

This literature review regarding cloud computing research faces some limitations itself. First, this literature review mainly covers the years up to October/November 2011. Presumably additional articles were published in the meantime, which should be included in a future version. Second, this review investigated only articles published in a selection of top journals, and seven conferences without using backward and forward search (Levy and Ellis, 2006; Webster and Watson, 2002). However, we believe the identified articles, the detailed and transparent documentation of the literature search process, the proposed categorization of cloud research as well as the research agenda offer useful insights into this emerging field of research.

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